

# ***PBEEEP***

## ***State Government***

### **Public Buildings Enhanced Energy Efficiency Program**

#### **Final Report Investigation Results For BCA St Paul Building**



**Date: 3/2/2012**



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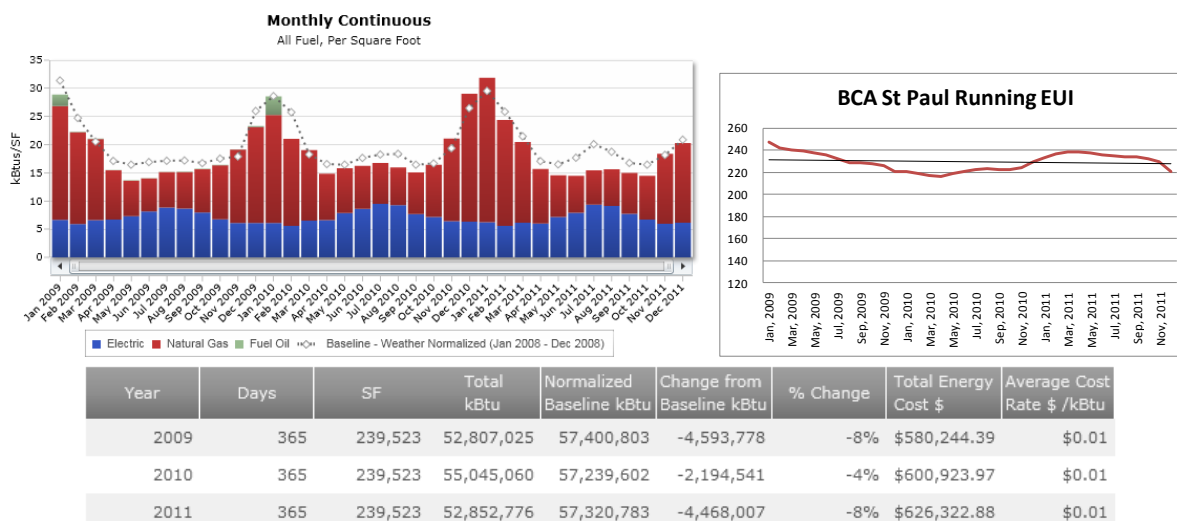
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## BCA St. Paul Building Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of BCA St. Paul Building was performed by Hammel, Green and Abrahamson, Inc. This report is the result of that information.

Payback Information and Energy Savings					
Total project costs (Without Co-funding)			Project costs with Co-funding		
Total costs to date including study	\$48,018		Total Project Cost	\$667,173	
Future costs including Implementation , Measurement & Verification	\$619,155		Study and Administrative Cost Paid with ARRA Funds	(\$51,018)	
Total Project Cost	\$667,173		Utility Co-funding	(\$25,000)	
			Total costs after co-funding	\$591,155	
Estimated Annual Total Savings (\$)	\$90,344		Estimated Annual Total Savings (\$)	\$90,344	
Total Project Payback	7.4		Total Project Payback with co-funding	6.5	
<b>Electric Energy Savings</b> (854,589 of 5,895,920 kWh (2011))			<b>Natural Gas Savings</b> (69,326 of 239,523 Therms (2011))		
14.5%			and 28.9%		



BCA St. Paul Building Consumption Report  
Total energy use remained constant during the period of the investigation

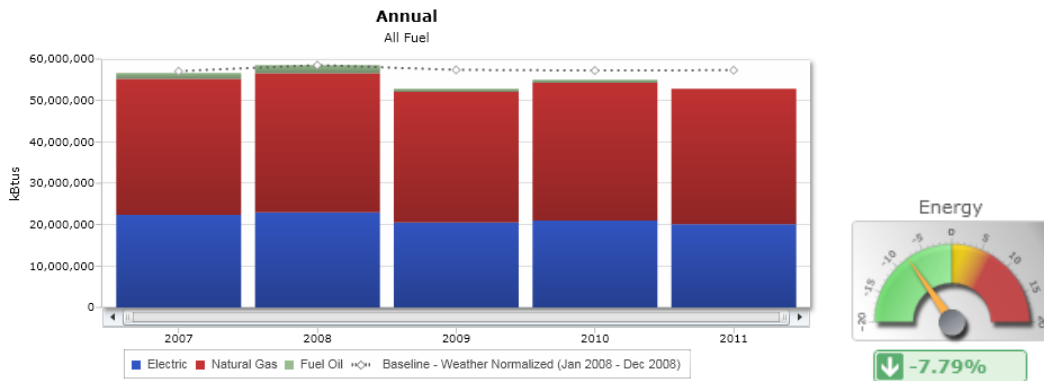


STATE OF MINNESOTA B3 BENCHMARKING

## Summary Tables

BCA St. Paul Building	
Location	1430 Maryland Ave. East, St. Paul, MN 55106
Facility Manager	Gordon Specht
Interior Square Footage	235,414
PBEEEP Provider	Hammel, Green and Abrahamson, Inc.
State's Project Manager	Harvey Jaeger
Annual Energy Cost	\$ 626,329 (2011) Source: B3
Utility Company	Xcel Energy (Electric and Natural Gas)
Site Energy Use Index (EUI)	220 kBtu/ft <sup>2</sup> (at start of study) 221 kBtu/ft <sup>2</sup> (at end of study)
Benchmark EUI (from B3)	216 kBtu/ft <sup>2</sup>

Building Name	State ID	Area (Square Feet)	Year Built
BCA St. Paul Building	G0231026362	235,414	2003
Mechanical Equipment Summary Table (of buildings included in the investigation)			
Quantity	Equipment Description		
1	Building Automation System (Honeywell EBI), part of the State Capitol Complex		
7	Air Handlers		
120	Exhaust Fans		
263	VAV Boxes		
2	Chillers		
2	Cooling Towers with Fans		
4	Boilers		
11	Hot Water Pumps		
200	Approximate number of points recommended trended, plus 5 data loggers		



**5 Year Energy Use Shows a 7.8% decrease from the B3 Baseline Year**

Implementation Information			
Estimated Annual Total Savings (\$)			\$90,344
Total Estimated Implementation Cost (\$)			\$616,144
GHG Avoided in U.S Tons (CO2e)			1,116
Electric Energy Savings (kWh)		14.5 % Savings	
2011 Electric Usage 5,895,920 kWh (from B3)			854,589
Electric Demand Savings (Peak kW)		0 % Savings	
2010 Peak Demand 1,008 kW			0
Natural Gas Savings		28.9% Savings	
2011 Natural Gas Usage 239,523Thermsfrom B3			69,236
Statistics			
Number of Measures identified			2
Number of Measures with payback < 3 years			1
Screening Start Date	5/3/2010	Screening End Date	7/29/2010
Investigation Start Date	9/30/2010	Investigation End Date	11/07/2011
Final Report	3/2//2012		

BCA St. Paul Building Cost Information			
Phase		To date	Estimated
Screening		\$4,040	
Investigation [Provider]		\$38,200	
Investigation [CEE]		\$5,778	\$1,000
Implementation			\$616,155
Implementation [CEE]			\$1,000
Measurement & Verification		0	\$1,000
Total		\$48,018	\$619,155

Co-funding Summary	
Study and Administrative Cost	\$51,018
Utility Co-Funding - Estimated Total (\$)	\$25,000
Total Co-funding (\$)	\$76,018

## Facility Overview

The energy investigation identified 18.6% of total energy savings at BCA St. Paul Building with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at BCA St. Paul Building are based on adjusting the schedule of equipment to match actual building occupancy hours, and installing a variable flow exhaust system on many of the laboratory hoods. The total cost of implementing all the measures is \$616,155.

Implementing all these measures can save the facility approximately \$90,344 a year with a combined payback period of 6.8 years before rebates based on the implementation cost only (excluding study and administrative costs). After rebates the site will have a cost of \$591,155, which reduces the payback to 6.5 years. These measures will produce 14.5% electrical savings and 28.9% natural gas savings. The building is currently performing at 2% above the Minnesota Benchmarking and Beyond database (B3) benchmark.

The primary energy intensive systems at BCA St. Paul Building are described here:

The Bureau of Criminal Apprehension (BCA) St. Paul is one large building consisting of 235,414 interior square feet. It was built in 2003 and never commissioned. The building contains a large amount of lab space and therefore contains a large number of exhaust fans. There are three floors as well as a penthouse. Floor layouts follow at the end of this report.

The building has a total of 2 chillers, 4 boilers, 7 AHUs, 120 exhaust fans, and 263 VAV boxes. Two of the boilers are used to produce hot water. There are two different hot water loops. One of the hot water loops supplies hot water directly from the boiler to the VAV reheats. The other loop passes hot water from the boiler through two heat exchangers which transfers energy from the boiler water to a glycol hot water system for the heat coils within the AHUs. The other two boilers produce steam for humidification. Six of the AHUs contain humidifier coils in them. There is also a small parking garage attached to the building which is about 600 ft<sup>2</sup>. The only equipment which serves this space is two exhaust fans.

Due to the large amount of air exhausted out of the building, 6 of the AHUs utilize heat reclaim. Each of these AHUs contains an exhaust fan which draws air through a heat reclaim water system. This system is used for both the heating and cooling seasons. This helps reduce the amount of energy used to condition the large amount of OA. The heat reclaim system primarily captures exhaust air energy from the third floor.

Most of the interior lighting consists of T8 28 watt lights. These lights are mainly controlled by switches.

The building is controlled by the State Capitol Complex Honeywell EBI automation system. It is operated by the Plant Management Division (PMD) of the Department of Administration

The site Energy Use Index (EUI) for the campus is 221 kBtu/ft<sup>2</sup>, which is 2% higher than the B3 Benchmark of 216 kBtu/ft<sup>2</sup>. This benchmark was determined by assuming the building is approximately 40% laboratory space, 60% office space.

There are 2 gas meters, (1interruptible and 1firm); 1 electrical meter and #2 fuel oil for use when natural gas is curtailed.



## Findings Summary

Building: Bureau of Criminal Apprehension

Site: BCA St Paul

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
3	Building Occupancy Settings	\$150,000	\$50,172	2.99	\$0	2.99	685
2	Fume Hood Exhaust Air Quantity	\$466,155	\$40,172	11.60	\$0	11.60	432
	<b>Total for Findings with Payback 3 years or less:</b>	<b>\$150,000</b>	<b>\$50,172</b>	<b>2.99</b>	<b>\$0</b>	<b>2.99</b>	<b>685</b>
	<b>Total for all Findings:</b>	<b>\$616,155</b>	<b>\$90,344</b>	<b>6.82</b>	<b>\$0</b>	<b>6.82</b>	<b>1,116</b>

## Findings Glossary: Findings Examples

<b>a.1 (1)</b>	<b>Time of Day enabling is excessive</b>
	<ul style="list-style-type: none"> <li>• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy</li> <li>• Optimum start-stop is not implemented</li> <li>• Controls in hand</li> </ul>
<b>a.2 (2)</b>	<b>Equipment is enabled regardless of need, or such enabling is excessive</b>
	<ul style="list-style-type: none"> <li>• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design.</li> <li>• Supply air temperature and pressure reset: cooling and heating</li> </ul>
<b>a.3 (3)</b>	<b>Lighting is on more hours than necessary</b>
	<ul style="list-style-type: none"> <li>• Lighting is on at night when the building is unoccupied</li> <li>• Photocells could be used to control exterior lighting</li> <li>• Lighting controls not calibrated/adjusted properly</li> </ul>
<b>a.4 (4)</b>	<b>OTHER Equipment Scheduling and Enabling</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>b.1 (5)</b>	<b>Economizer Operation – Inadequate Free Cooling</b>
	<ul style="list-style-type: none"> <li>• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer)</li> <li>• Economizer linkage is broken</li> <li>• Economizer setpoints could be optimized</li> <li>• Plywood used as the outdoor air control</li> <li>• Damper failed in minimum or closed position</li> </ul>
<b>b.2 (6)</b>	<b>Over-Ventilation</b>
	<ul style="list-style-type: none"> <li>• Demand-based ventilation control has been disabled</li> <li>• Outside air damper failed in an open position</li> <li>• Minimum outside air fraction not set to design specifications or occupancy</li> </ul>
<b>b.3 (7)</b>	<b>OTHER Economizer/Outside Air Loads</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>c.1 (8)</b>	<b>Simultaneous Heating and Cooling is present and excessive</b>
	<ul style="list-style-type: none"> <li>• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously</li> <li>• Different setpoints are used for two systems serving a common zone</li> </ul>
<b>c.2 (9)</b>	<b>Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement</b>
	<ul style="list-style-type: none"> <li>• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation</li> <li>• Zone sensors need to be relocated after tenant improvements</li> <li>• OAT sensor reads high in sunlight</li> </ul>
<b>c.3 (10)</b>	<b>Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints</b>
	<ul style="list-style-type: none"> <li>• CHW valve cycles open and closed</li> <li>• System needs loop tuning – it is cycling between heating and cooling</li> </ul>
<b>c.4 (11)</b>	<b>OTHER Controls</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>d.1 (12)</b>	<b>Daylighting controls or occupancy sensors need optimization</b>
	<ul style="list-style-type: none"> <li>• Existing controls are not functioning or overridden</li> <li>• Light sensors improperly placed or out of calibration</li> </ul>
<b>d.2 (13)</b>	<b>Zone setpoint setup / setback are not implemented or are sub-optimal</b>
	<ul style="list-style-type: none"> <li>• The cooling setpoint is 74 °F 24 hours per day</li> </ul>
<b>d.3 (14)</b>	<b>Fan Speed Doesn't Vary Sufficiently</b>
	<ul style="list-style-type: none"> <li>• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design.</li> <li>• Supply air temperature and pressure reset: cooling and heating</li> </ul>

<b>d.4 (15)</b>	<b>Pump Speed Doesn't Vary Sufficiently</b>
	<ul style="list-style-type: none"> <li>• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low <math>\Delta T</math> across the chiller during low load conditions.</li> </ul>
<b>d.5 (16)</b>	<b>VAV Box Minimum Flow Setpoint is higher than necessary</b>
	<ul style="list-style-type: none"> <li>• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.</li> </ul>
<b>d.6 (17)</b>	<b>Other Controls (Setpoint Changes)</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>e.1 (18)</b>	<b>HW Supply Temperature Reset is not implemented or is sub-optimal</b>
	<ul style="list-style-type: none"> <li>• HW supply temperature is a constant 180 °F. It should be reset based on demand, or decreased by a reset schedule as OAT increases.</li> <li>• DHW Setpoints are constant 24 hours per day</li> </ul>
<b>e.2 (19)</b>	<b>CHW Supply Temperature Reset is not implemented or is sub-optimal</b>
	<ul style="list-style-type: none"> <li>• CHW supply temperature is a constant 42 °F. It could be reset, based on demand or ambient temperature.</li> </ul>
<b>e.3 (20)</b>	<b>Supply Air Temperature Reset is not implemented or is sub-optimal</b>
	<ul style="list-style-type: none"> <li>• The SAT is constant at 55 °F. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.</li> </ul>
<b>e.4 ( )</b>	<b>Supply Duct Static Pressure Reset is not implemented or is suboptimal</b>
	<ul style="list-style-type: none"> <li>• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.</li> </ul>
<b>e.5 (21)</b>	<b>Condenser Water Temperature Reset is not implemented or is sub-optimal</b>
	<ul style="list-style-type: none"> <li>• CW temperature is constant leaving the tower at 85 °F. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.</li> </ul>
<b>e.6 (22)</b>	<b>Other Controls (Reset Schedules)</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>f.1 (23)</b>	<b>Lighting system needs optimization - Spaces are overlit</b>
	<ul style="list-style-type: none"> <li>• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks</li> </ul>
<b>f.2 (24)</b>	<b>Pump Discharge Throttled</b>
	<ul style="list-style-type: none"> <li>• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.</li> </ul>
<b>f.3 (25)</b>	<b>Over-Pumping</b>
	<ul style="list-style-type: none"> <li>• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.</li> </ul>
<b>f.4 (26)</b>	<b>Equipment is oversized for load</b>
	<ul style="list-style-type: none"> <li>• The equipment cycles unnecessarily</li> <li>• The peak load is much less than the installed equipment capacity</li> </ul>

<b>f.5 (27)</b>	<b>OTHER Equipment Efficiency/Load Reduction</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>g.1 (28)</b>	<b>VFD Retrofit Fans</b>
	<ul style="list-style-type: none"> <li>• Fan serves variable flow system, but does not have a VFD.</li> <li>• VFD is in override mode, and was found to be not modulating.</li> </ul>
<b>g.2 (29)</b>	<b>VFD Retrofit - Pumps</b>
	<ul style="list-style-type: none"> <li>• 3-way valves are used to maintain constant flow during low load periods.</li> <li>• Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.</li> </ul>
<b>g.3 (30)</b>	<b>VFD Retrofit - Motors (process)</b>
	<ul style="list-style-type: none"> <li>• Motor is constant speed and uses a variable pitch sheave to obtain speed control.</li> </ul>
<b>g.4 (31)</b>	<b>OTHER VFD</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>h.1 (32)</b>	<b>Retrofit - Motors</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed motor is much lower than efficiency of currently available motors</li> </ul>
<b>h.2 (33)</b>	<b>Retrofit - Chillers</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed chiller is much lower than efficiency of currently available chillers</li> </ul>
<b>h.3 (34)</b>	<b>Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners</li> </ul>
<b>h.4 (35)</b>	<b>Retrofit - Boilers</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed boiler is much lower than efficiency of currently available boilers</li> </ul>
<b>h.5 (36)</b>	<b>Retrofit - Packaged Gas-fired heating</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed heaters is much lower than efficiency of currently available heaters</li> </ul>
<b>h.6 (37)</b>	<b>Retrofit - Heat Pumps</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps</li> </ul>
<b>h.7 (38)</b>	<b>Retrofit - Equipment (custom)</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed equipment is much lower than efficiency of currently available equipment</li> </ul>
<b>h.8 (39)</b>	<b>Retrofit - Pumping distribution method</b>
	<ul style="list-style-type: none"> <li>• Current pumping distribution system is inefficient, and could be optimized.</li> <li>• Pump distribution loop can be converted from primary to primary-secondary)</li> </ul>
<b>h.9 (40)</b>	<b>Retrofit - Energy / Heat Recovery</b>
	<ul style="list-style-type: none"> <li>• Energy is not recouped from the exhaust air.</li> <li>• Identification of equipment with higher effectiveness than the current equipment.</li> </ul>
<b>h.10 (41)</b>	<b>Retrofit - System (custom)</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed system is much lower than efficiency of another type of system</li> </ul>
<b>h.11 (42)</b>	<b>Retrofit - Efficient lighting</b>
	<ul style="list-style-type: none"> <li>• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.</li> </ul>

<b>h.12 (43)</b>	<b>Retrofit - Building Envelope</b>
	<ul style="list-style-type: none"> <li>• Insulation is missing or insufficient</li> <li>• Window glazing is inadequate</li> <li>• Too much air leakage into / out of the building</li> <li>• Mechanical systems operate during unoccupied periods in extreme weather</li> </ul>
<b>h.13 (44)</b>	<b>Retrofit - Alternative Energy</b>
	<ul style="list-style-type: none"> <li>• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design</li> </ul>
<b>h.14 (45)</b>	<b>OTHER Retrofit</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>i.1 (46)</b>	<b>Differed Maintenance from Recommended/Standard</b>
	<ul style="list-style-type: none"> <li>• Differed maintenance that results in sub-optimal energy performance.</li> <li>• Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.</li> </ul>
<b>i.2 (47)</b>	<b>Impurity/Contamination</b>
	<ul style="list-style-type: none"> <li>• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.</li> </ul>
<b>i.3 ( )</b>	<b>Leaky/Stuck Damper</b>
	<ul style="list-style-type: none"> <li>• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.</li> </ul>
<b>i.4 ( )</b>	<b>Leaky/Stuck Valve</b>
	<ul style="list-style-type: none"> <li>• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.</li> </ul>
<b>i.5 (48)</b>	<b>OTHER Maintenance</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>
<b>j.1 (49)</b>	<b>OTHER</b>
	<ul style="list-style-type: none"> <li>• Please contact PBEEEP Project Engineer for approval</li> </ul>

# Findings Details



## Building: Bureau of Criminal Apprehension

FWB Number:	11900	Eco Number:	2
Site:	BCA St Paul	Date/Time Created:	2/27/2012

Investigation Finding:	Fume Hood Exhaust Air Quantity	Date Identified:	11/2/2010
Description of Finding:	All building and lab exhaust fans operate 24/7, regardless of building occupancy or use. This includes all Fume hoods and general exhaust for laboratory spaces. It was detected through trending of all exhaust VAV boxes. The fume hoods are currently setup to exhaust the same CFM 24/7 regardless of use. With the appropriate controls implemented, it is possible to greatly reduce the fume hood exhaust rate when the fume hood is not in use.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	Contractor, RCxP, In-House Staff	Benefits:	Energy Savings
Baseline Documentation Method:	BAS Point Trending		
Measure:	Implementing new controls in the lab spaces and at each fume hood will allow the total exhaust CFM to be greatly reduced for energy savings.		
Recommendation for Implementation:	Design firm shall work with the facility to verify all spaces which can be converted to a variable flow exhaust system. Scope of work to include new component specifications, room airflow analysis, and controls sequences. New components are to be installed to accommodate varying exhaust flow rates due to occupant fume hood usage. Devices to be included are as follows: TSI SURFLOW Controller which includes a wall mount digital interface panel, DDC control panel and RTD temperature sensor. Inputs to controller include 4 supply flows, 2 general exhaust flows, 7 fume hood flows, temperature, and occupied/unoccupied settings. Outputs include supply flow control, exhaust flow control, reheat valve control and BACnet interface. In addition to the controller, a TSI fast acting actuator and flow transducer shall be provided for each VAV box. The fume hoods shall be updated with Fume Hood Face Velocity Controller. The controller will have a LCD display, indication lights, alarm buzzer, control output, and BACnet interface. The other components to be included are fast acting electric actuator and flow transducer. The fume hood will also be equipped with the conversion kit to turn the fume hood from a constant volume fume hood to a bypass fume hood. Controls sequences will be altered to reduce the outdoor air level in the building. Currently, the outdoor air dampers are set to a minimum of 50% all the time with the exception of economizer settings. New controls will help to modulate these dampers to reduce the outdoor air implemented into the building. Additional research will be conducted to verify the new minimum outdoor air level for the building to meet current codes.		
Evidence of Implementation Method:	Trending of multiple points for a two week period during both summer and winter seasons will demonstrate a reduction in exhaust air and outdoor air CFM. The points to be trended include MAT, OA Damper position, OA CFM to demonstrate the reduction in outside air being delivered by the AHU. In addition, the exhaust fan VFD speed, exhaust airflow, and exhaust VAV airflow shall be trended to verify a reduction in exhaust air. It should be possible to see when a fume hood is used due to the sudden increase in fume hood exhaust CFM from the trended data. In addition to the specific points related to exhaust and outdoor air, all air handling unit points will be trended including DAT, RAT, supply, return, and exhaust air CFM, and all damper positions.		

Annual Electric Savings (kWh):	158,260	Annual Natural Gas Savings (therms):	53,466
Estimated Annual kWh Savings (\$):	\$9,323	Estimated Annual Natural Gas Savings (\$):	\$30,849
Contractor Cost (\$):	\$416,155		
PBEEP Provider Cost for Implementation Assistance (\$):	\$50,000		
Total Estimated Implementation Cost (\$):	\$466,155		

Estimated Annual Total Savings (\$):	\$40,172	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	11.60	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	11.60	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	432	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	44.5%	Percent of Implementation Costs:	75.7%

# Findings Details



## Building: Bureau of Criminal Apprehension

FWB Number:	11900	Eco Number:	3
Site:	BCA St Paul	Date/Time Created:	2/27/2012

Investigation Finding:	Building Occupancy Settings	Date Identified:	11/2/2010
Description of Finding:	The building currently operates 24/7 as if it is fully occupied at all times. Upon working at the facility, the amount of staff present during non-typical office times is limited. It has been discussed that certain areas of the facility are occupied 24/7, some areas require strict temperature and humidity tolerances, and individuals sometimes work nights and weekends. All of these instances will need additional evaluation. The limited use of the facility was verified through site visits and spot trending of lighting with the use of data loggers placed in random locations.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	In-House Staff	Benefits:	Energy Savings
Baseline Documentation Method:	BAS Point Trending		
Measure:	Reducing the building operation will reduce energy consumption during times when people are not present.		
Recommendation for Implementation:	The calculation demonstrates energy savings related to a reduced operation of air handling units. The assumption for the calculation was the building would operate 12 hours per day (6AM-6PM), 7 days a week. This calculation demonstrates potential energy savings for the facility. Additional research will be conducted by the design team to discover zone requirements. It has been discussed with facility representatives that certain areas of the building are occupied 24/7 and certain areas of the building are occupied less than the calculation has assumed. Controls strategies and sensors would allow the facility to control specific air handling unit equipment as required such as occupancy sensors and switches, zone temperature and humidity sensors, and varying equipment setback controls strategies to disable and enable equipment when required. A zone by zone study will need to be conducted to verify exact space requirements and how alterations will effect each respective zone's energy use.		
Evidence of Implementation Method:	Trending of all air handling unit points will verify a reduction of AHU operation. These points include all VFD speeds for return fans, supply fans, exhaust fans, damper positions, MAT, RAT, DAT, EAT, OAT and all valve positions. Trending of these points for a two week period on 15 minute intervals during both summer and winter seasons will demonstrate a reduction in equipment use.		

Annual Electric Savings (kWh):	696,329	Annual Natural Gas Savings (therms):	15,860
Estimated Annual kWh Savings (\$):	\$41,021	Estimated Annual Natural Gas Savings (\$):	\$9,151
Contractor Cost (\$):	\$100,000		
PBEEEP Provider Cost for Implementation Assistance (\$):	\$50,000		
Total Estimated Implementation Cost (\$):	\$150,000		

Estimated Annual Total Savings (\$):	\$50,172	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	2.99	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	2.99	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	685	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	55.5%	Percent of Implementation Costs:	24.3%

# Investigation Checklist



Rev. 2.0 (12/16/2010)

## P11900 - BCA-St Paul

This checklist is designed to be a resource and reference for Providers and PBEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	<a href="#">Time of Day enabling is excessive</a>	Building Operates 24/7	Mech Room		Operate building 24/7 due to potential overnight occupancy. Overnight Occupancy seems limited.
	a.2 (2)	<a href="#">Equipment is enabled regardless of need, or such enabling is excessive</a>			Investigation looked for, but did not find this issue.	
	a.3 (3)	<a href="#">Lighting is on more hours than necessary.</a>			Investigation looked for, but did not find this issue.	Lighting is on when people present. Overnight lights turned off unless occupied.
	a.4 (4)	<a href="#">OTHER Equipment Scheduling/Enabling</a>			Not Relevant	
b. Economizer/Outside Air Loads:	b.1 (5)	<a href="#">Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)</a>				OA levels are large due to 24/7 exhaust of space and fume hoods, %OA increases for economizer.
	b.2 (6)	<a href="#">Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.</a>				OA levels are large due to 24/7 exhaust of space and fume hoods
	b.3 (7)	<a href="#">OTHER Economizer/OA Loads</a>			Not Relevant	
c. Controls Problems:	c.1 (8)	<a href="#">Simultaneous Heating and Cooling is present and excessive</a>			Investigation looked for, but did not find this issue.	No simultaneous at AHU's, reheats are used in VAV boxes 24/7. Trend data indicates HW and CHW coils not open at same time.
	c.2 (9)	<a href="#">Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement</a>			Investigation looked for, but did not find this issue.	
	c.3 (10)	<a href="#">Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints</a>			Investigation looked for, but did not find this issue.	
	c.4 (11)	<a href="#">OTHER Controls</a>			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	<a href="#">Daylighting controls or occupancy sensors need optimization.</a>			Not Relevant	Facility does not utilize Daylight controls. Occupancy sensors in many locations, lights are off when nobody present.
	d.2 (13)	<a href="#">Zone setpoint setup/setback are not implemented or are sub-optimal.</a>				Building is at constant setpoint 24/7 due to differing occupancy. Will investigate cost to operate during non-typical office hours.
	d.3 (14)	<a href="#">Fan Speed Doesn't Vary Sufficiently</a>			Investigation looked for, but did not find this issue.	Fan speed varies with time, when occupancy low, SA flow decreases (overnight).
	d.4 (15)	<a href="#">Pump Speed Doesn't Vary Sufficiently</a>			Not cost-effective to investigate	Pump speed seems relatively constant, delta T is constant as well.
	d.5 (16)	<a href="#">VAV Box Minimum Flow Setpoint is higher than necessary</a>				VAV boxes are relatively constant as makeup air for lab spaces is high. Building occupancy varies but operates as if it is fully occupied.
	d.6 (17)	<a href="#">Other Controls (Setpoint Changes)</a>			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	<a href="#">HW Supply Temperature Reset is not implemented or is sub-optimal</a>			Investigation looked for, but did not find this issue.	HW Delta T great due to large OA quantity. Generally greater than 30 degree all the time.
	e.2 (19)	<a href="#">CHW Supply Temperature Reset is not implemented or is sub-optimal</a>			Investigation looked for, but did not find this issue.	CHW Delta T great due to large OA quantity. About 10 degree all the time
	e.3 (20)	<a href="#">Supply Air Temperature Reset is not implemented or is sub-optimal</a>			Not Relevant	Systems utilize VFD's, DAT needed to satisfy building loads.
	e.4 ( )	<a href="#">Supply Duct Static Pressure Reset is not implemented or is sub-optimal</a>			Investigation looked for, but did not find this issue.	VFD's do modulate during building schedule, overnight CFM values reduced when building is unoccupied.
	e.5 (21)	<a href="#">Condenser Water Temperature Reset is not implemented or is sub-optimal</a>			Investigation looked for, but did not find this issue.	Condenser water leaving temperature ranges from 72 to 95 degrees.
	e.6 (22)	<a href="#">Other Controls (Reset Schedules)</a>			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	<a href="#">Daylighting Control needs optimization—Spaces are Over-Lit.</a>			Not Relevant	No daylight system is in place at facility.
	f.2 (24)	<a href="#">Pump Discharge Throttled</a>			Investigation looked for, but did not find this issue.	
	f.3 (25)	<a href="#">Over-Pumping</a>				
	f.4 (26)	<a href="#">Equipment is oversized for load.</a>			Investigation looked for, but did not find this issue.	Water system have reasonable delta T's, don't appear to be oversized.
	f.5 (27)	<a href="#">OTHER Equipment Efficiency/Load Reduction</a>			Not Relevant	
	g.1 (28)	<a href="#">VFD Retrofit - Fans</a>			Investigation looked for, but did not find this issue.	AHU equipment well suited for VFD's already in place.

# Investigation Checklist



Rev. 2.0 (12/16/2010)

## P11900 - BCA-St Paul

This checklist is designed to be a resource and reference for Providers and PBEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	<a href="#">VFD Retrofit - Pumps</a>			Investigation looked for, but did not find this issue.	Pumping equipment well suited for VFD's already in place.
	g.3 (30)	<a href="#">VFD Retrofit - Motors (process)</a>			Not Relevant	
	g.4 (31)	<a href="#">OTHER VFD</a>			Not Relevant	
h. Retrofits:	h.1 (32)	<a href="#">Retrofit - Motors</a>			Not cost-effective to investigate	Newer facility resulting in more efficient equipment.
	h.2 (33)	<a href="#">Retrofit - Chillers</a>			Not cost-effective to investigate	Newer facility resulting in more efficient equipment.
	h.3 (34)	<a href="#">Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)</a>			Not Relevant	
	h.4 (35)	<a href="#">Retrofit - Boilers</a>			Not cost-effective to investigate	Newer facility resulting in more efficient equipment.
	h.5 (36)	<a href="#">Retrofit - Packaged Gas fired heating</a>			Not Relevant	
	h.6 (37)	<a href="#">Retrofit - Heat Pumps</a>			Not Relevant	
	h.7 (38)	<a href="#">Retrofit - Equipment (custom)</a>			Not Relevant	
	h.8 (39)	<a href="#">Retrofit - Pumping distribution method</a>			Not cost-effective to investigate	Primary/Secondary pumping distribution for HWS and CHWS.
	h.9 (40)	<a href="#">Retrofit - Energy/Heat Recovery</a>			Not cost-effective to investigate	Currently utilizes heat recovery of exhaust air.
	h.10 (41)	<a href="#">Retrofit - System (custom)</a>			Not Relevant	
	h.11 (42)	<a href="#">Retrofit - Efficient Lighting</a>			Not cost-effective to investigate	
	h.12 (43)	<a href="#">Retrofit - Building Envelope</a>			Not cost-effective to investigate	Newer facility resulting with limited envelope issues.
	h.13 (44)	<a href="#">Retrofit - Alternative Energy</a>			Not Relevant	
	h.14 (45)	<a href="#">OTHER Retrofit</a>			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	<a href="#">Differed Maintenance from Recommended/Standard</a>			Not Relevant	
	i.2 (47)	<a href="#">Impurity/Contamination</a>			Not Relevant	
	i.3 ( )	<a href="#">Leaky/Stuck Damper</a>			Investigation looked for, but did not find this issue.	Facility engineer indicated OA dampers sometimes have issues. This is a result of controls strategy, dampers are fixed at 50% for OA min.
	i.4 ( )	<a href="#">Leaky/Stuck Valve</a>			Investigation looked for, but did not find this issue.	
	i.5 (48)	<a href="#">OTHER Maintenance</a>			Not Relevant	
j. OTHER	j.1 (49)	<a href="#">OTHER</a>			Not Relevant	



April 11, 2012

WRITER'S DIRECT DIAL 612-758-4227

Mr. Gordon Specht  
Building Manager  
Administration Department  
50 Sherburne Avenue  
St. Paul, Minnesota 55155

Re: State of Minnesota-BCA-St Paul-PBEEEP Investigation  
HGA Commission Number 0476-041-00

Dear Mr. Specht:

Please see below for findings of the PBEEEP Investigation.

### **Fume Hood Exhaust Air Quantity**

The current fume hood operation at the BCA includes approximately 41,000 CFM of constant volume exhaust airflow from the current fume hood operation. The trend data for the exhaust VAV boxes indicates the exhaust for the building is constant volume as these fume hoods operate with a bypass exhaust configuration. Upon discussions with building staff, it was discovered a large percentage of these fume hoods are used on an intermittent basis creating a large amount of excess exhaust resulting in makeup air conditioning of unnecessary air. In addition to excess exhaust, it was discovered the overall building experiences pressure control issues. The outdoor air damper trend indicates they sometimes modulate for economizer operation but generally are fixed at a minimum position of 50%. With minimal monitoring of the outdoor air and space pressure, pressure issues become a problem within the space. For purposes of making reasonable assumptions, the calculation assumes all fume hoods operate at the maximum CFM during occupied times and the new minimum CFM for the fume hoods during unoccupied times. It is assumed the exhaust CFM for the fume hoods will be considerably less than the calculated value.

The estimated cost for implementation within the report is a summation of conversion for all the fume hoods and labs scheduled within the building. The implementation cost includes conversion of supply and return VAV box actuators to fast acting actuators, a TSI SURFLOW controller which includes a wall mounted digital interface panel. The controller includes inputs for 4 supply flows, 2 general exhaust flows and 7 fume hood flows with associated temperature and occupied/unoccupied settings. The outputs for the controller include supply flow control, exhaust flow control, reheat valve control, and a BACnet interface. The fume hoods will be altered to

Mr. Gordon Specht  
April 11, 2012  
Page 2

include a Fume Hood Face Velocity controller as well as a conversion kit to alter the fume hood to a non-constant volume hood.

For purposes of comparison, the payback for the whole building was studied as well as that of a single large lab and a single small lab. The large lab studied for comparison was the Toxicology Main Lab. The calculated energy savings for this large lab resulted in a payback of 8 years with implementation costs of about \$50,000. The small lab identified was the Toxicology prep area. The conversion of a small lab area resulted in a payback of about 17 years with implementation costs of about \$10,000.

### **Building Occupancy Settings**

The purpose of this measure was to identify the energy consumption of the building during low occupancy times. The calculations show the energy costs associated with the existing full-time operation of the equipment. It is well known the facility has special circumstances requiring certain equipment to operate during all hours due to overnight occupancy or space sensitive temperature and humidity requirements. A space-by-space usage study would need to be completed to determine the occupancy requirements as well as temperature and humidity requirements for each space. The final controls design would allow the controls systems to accommodate any special circumstances. The savings calculation assumed that some of the equipment will require 24/7 operation and some of the equipment will operate less than the calculated 12 hours per day.

Please contact me directly with any questions at 612-758-4227 or [tmell@hga.com](mailto:tmell@hga.com).

Sincerely,

A handwritten signature in black ink, appearing to read 'Todd Mell', with a stylized flourish at the end.

Todd Mell, LEED AP  
Mechanical Department

cc: Kate Zwicky, HGA

s:\0000\476\041-00\1. general communications\correspondence\20120411-tm-letter to specht.docx;vc



414 Nicollet Mall, GO-6  
Minneapolis, MN 55401

1-800-481-4700  
xcelenergy.com

State of MN - Bureau of Criminal Apprehension  
Harvey Jaeger  
1430 Maryland Ave E  
St Paul, MN 55106

3/30/2012

Dear Harvey:

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed and approved your Recommissioning study. Please review the results with your Xcel Energy representative, Al Joe.

After they have presented the report to you, please submit the following to your Xcel Energy representative:

- Completed Recommissioning Study Rebate Application
- Copy of the paid study invoice
- Completed Customer implementation plan, which can be found in the 2<sup>nd</sup> tab of the attached rebate form

After we receive these, we will process your study rebate check and mail it to you.

**Remember, you need to submit these within 3 months.**

We encourage you to implement the measures recommended in your report. When you know which measures you plan on implementing, please notify your Xcel Energy representative.

Your Recommissioning implementation rebate form is also enclosed. When you have implemented any of the recommissioning measures, please sign and date a copy of the rebate form and include the costs per measure implemented on the 2<sup>nd</sup> tab. Send this along with your itemized invoices to your Xcel Energy Account Manager.

### **Earn Bonus Rebates by Implementing Within 9 Months!**

You can now earn a significant bonus rebate (up to 100%) if you implement and submit your recommissioning measures within nine months of this study approval date.

**You will earn an additional \$0.03/kWh and/or \$3/Dth on ALL qualifying RCx measures submitted within 9 months of study approval.** That's in addition to the \$0.045/kWh and/or \$5/Dth you can already earn for measures that have paybacks 9 months - 15 years. Normally, you can't earn rebates on measures with paybacks less than 9 months, but now is your chance to earn rebates on ALL recommissioning measures, even those that are low to no cost with quick paybacks!

Bonus details:

- Max bonus rebate is \$10,000 or the total out-of-pocket costs for the study – whichever is lower. You could potentially pay \$0 out-of-pocket for your recommissioning study!

- All recommissioning energy-saving measures are eligible for a rebate, including measures that pay back in less than nine months.
- Invoices and signatures must be dated May 1, 2011 or later to qualify.
- Available for recommissioning measures only (prescriptive and custom measures identified in the study do not qualify).
- This bonus cannot be combined with any other bonus offer or bundle.
- The bonus ends Dec. 31, 2012 or nine months from your study approval date, whichever is earlier.
- Available in MN only.

For further questions about the bonus, please call your Xcel Energy Account Manager.

Sincerely,

Alex Birkholz  
Marketing Assistant, Recommissioning

Attachment

CC: Barb Jerhoff - Xcel Energy  
Sherryl Volkert - Xcel Energy  
Kate Zwicky – HGA



414 Nicollet Mall, GO-6  
Minneapolis, MN 55401

1-800-481-4700  
xcelenergy.com

November 12, 2010

**State of MN**  
**Attn: Harvey Jaeger**  
**50 Sherburne Ave. E.**  
**St. Paul, MN 55155**

Dear Harvey:

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed your study applications and proposals and have preapproved your studies. The following outlines your rebates and project information:

Building Address	BCA - 1430 Maryland Ave. E., St. Paul, MN 55106		
Study Cost	\$38,200.00	Study Number	RM1526
Preapproved study rebate*	\$25,000.00		
* Your rebate was based on the study cost provided. If the final study cost is lower, your rebate will be adjusted accordingly.			
Study Provider	HGA		
Account manager	Barb Jerhoff	Phone	651-229-5565
Building Address	State Office Bldg - 41 Aurora, St. Paul, MN 55101		
Study Cost	\$43,200.00	Study Number	RM1525
Preapproved study rebate*	\$23,475.00		

Here's a quick review of the Recommissioning program process:

- Once your studies are complete, your study provider will send a draft copy to us for review.
- After we complete our review and approve the studies, we will send you a confirmation letter noting our approval.
- Your study provider will schedule a wrap-up meeting with you and your Xcel Energy account manager to go over the results of the studies.
- You pay the study provider for the full cost of the studies.
- You submit the Recommissioning Study Rebate Application, along with a copy of the invoice and your Customer Implementation Plan, to us within 3 months of your report presentation. Please work with your account manager to complete the Customer Implementation Plan.
- We'll send your study rebate check to you.



414 Nicollet Mall, GO-6  
Minneapolis, MN 55401

1-800-481-4700  
xcelenergy.com

**Please note that we need to approve the final study in order to receive your study rebate.**

This study pre-approval is valid for **three months** from the date of this letter. If your studies will take longer than that, please let us know. If you have any questions or comments, please call your assigned Xcel Energy account manager. Thanks again for participating in our Recommissioning program.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jon Packer'.

Jon Packer  
Marketing Assistant, Recommissioning

Enclosure

CC: Barb Jerhoff - Xcel Energy  
Sherryl Volkert - Xcel Energy  
Kate Zwicky - HGA



V 12.02 MN

Type of Customer\*[illegible]

[illegible]



## Xcel Energy Recommissioning/Engineering Assistance Study Energy Conservation Opportunities Form

ECO#	Energy Conservation Opportunity	Estimated Summer Peak Demand Savings (kW)	Estimated Annual Energy Savings (kWh)	Estimated Gas Energy Savings (Dth)	Estimated Annual Electric Cost Savings	Estimated Annual Gas Cost Savings	Estimated Other Cost Savings	Estimated Gross Cost of Opportunity	Simple Payback Estimate (years)	Enter the Estimated Prescriptive Rebate	Estimated Recommissioning Conservation Rebate	Peak Ton Reduction (tons)	Ton-Hour Reduction (ton-hours/yr)	Steam Reduction (Mlbs/yr)	Hot Water Savings (MWh/yr)
Prescriptive Opportunities - The savings and rebate values are estimates only. Xcel Energy will determine final rebate after you submit a prescriptive rebate application.															
2	Building Occupancy Settings		819,210	1,866	\$41,021	\$9,151		\$150,000	2.99						
Custom Efficiency or Energy Management System Opportunities - The energy savings listed in this section are estimates only. Xcel Energy will determine final savings numbers for purposes of calculating potential rebates after you apply for the Custom/EMS program.															
1	Fume Hood Exhaust Air Quantity		186,188	6,290	\$9,323	\$30,849		\$466,155	11.60						
Other Savings Opportunities (Non-Rebatable energy savings, rate savings, load management, water savings, etc.)															
TOTALS															
	Recommissioning	0.00	0	0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	0	0	0
	Prescriptive	0.00	819,210	1,866	\$41,021	\$9,151	\$0	\$150,000	2.99	\$0		0	0	0	0
	Custom	0.00	186,188	6,290	\$9,323	\$30,849	\$0	\$466,155	11.60			0	0	0	0
	Other	0.00	0	0	\$0	\$0	\$0	\$0	0.00			0	0	0	0
	Total	0.00	1,005,398	8,156	\$50,344	\$40,000	\$0	\$616,155	6.82	6.82	\$0	\$0	0	0	0

**RULES & REQUIREMENTS**

01. By signing this form, customer does hereby certify that 1. All recommissioning work is complete and operational prior to submitting rebate application; and 2. All rules of this Xcel Energy program have been followed. Further, the customer acknowledges that participation in the rebate program shall impose no liability on Xcel Energy. In particular, Xcel Energy shall not be liable for the work performed by the customer's engineer, contractor, or vendor. Energy savings are estimates only. Actual savings may vary.

02. Actual rebate amounts subject to review by Xcel Energy. Measures implemented more than two years after study approval date will be reviewed and rebate recalculated.

03. Rebates are available for Xcel Energy electric and retail natural gas business customers in Minnesota only.

04. Customers must apply for rebates within one year of the purchase date shown on equipment invoice for a given measure.

05. Xcel Energy's conservation rebate programs are subject to 60 days' notice of cancellation. The customer is responsible for checking with the Business Solution Center at 1-800-481-4700 to ask whether or not the program is still in effect and to verify program parameters.

06. Customer should sign all implemented maintenance and recommissioning lines and submit to Xcel Energy Account Manager, along with invoices, upon completion to determine final rebate amount.

07. Customer is responsible for providing actual costs for each recommissioning measure implemented.

08. Xcel Energy reserves the right to conduct inspections of installations and/or make a reasonable number of follow-up visits to customer's facility to verify measure implementation and/or verify energy savings.

09. For Custom Efficiency or Energy Management System opportunities, customer is responsible for applying for preapproval before purchasing equipment in order to determine and qualify for a rebate.

10. In order for energy saving to be tabulated in the District Energy Recommissioning section, the provider of the Chilled Water, Hot Water, or Steam must use Xcel Energy as their fuel source for each product. See notes #13 & #14 for more information.

11. Vendor shall complete data entries in all unshaded columns (A-I), including zero (0) values, to generate simple payback and rebate calculations.

12. In Minnesota, the maximum total potential rebate bonus per building is the lower of the following: \$10,000 or the customer's out of pocket cost for the study, where out of pocket cost = study cost minus approved study rebate as outlined in your study approval letter. The actual bonus amount is dependant on the individual measures implemented and may vary from the amounts shown in column N. The bonus is available for measures implemented within 9 months of the customers study approval date and invoiced 5/1/11 or later in MN.

13. Select district is an Xcel electric customer box only if the customer uses: St. Paul Chilled Water, Hennepin Cty Energy Center Chilled Water, or NRG Chilled Water.

14. Select district is an Xcel gas customer box only if the customer uses: St. Paul Heating Water.

# ***PBEEEP***

## ***State Government***

### **Public Buildings Enhanced Energy Efficiency Program**

### **SCREENING RESULTS FOR BCA-St. Paul Building**



**Date: 7/29/2010**

### Summary Table

Facility Name	BCA-St. Paul Building
Location	1430 Maryland Ave. East, St. Paul, MN 55106
Facility Manager	Gordon Specht
Number of Buildings	1
Interior Square Footage	235,414
PBEEEP Provider	CEE (Neal Ray and Gustav Brandstrom)
State's Project Manager	Harvey Jaeger
Date Visited	May 3, 2010 and June 11, 2010
Annual Energy Cost	\$589,575 (2009)
Utility Company	Xcel Energy (Electricity and Natural Gas)
Site Energy Use Index (EUI)	182.2 kBtu/sq.ft-yr (2009)
Benchmark EUI (from B3)	239.2 kBtu/sq.ft-yr

### Recommendation for Investigation

A full investigation of the BCA-St. Paul is recommended.

Building Name	State ID	Area (Square Feet)	Year Built
BCA-St. Paul Building	G0231026362	235,414	2003

Mechanical Equipment Summary Table	
1	Honeywell RBI Building Automation System as part of the State Capitol Complex
235,414	Square Feet
7	Air Handlers
120	Exhaust Fans
263	VAV Boxes
2	Chillers
2	Cooling Towers with Fans
4	Boilers
11	Hot Water Pumps

## **BCA-St. Paul Building Screening Overview**

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. The screening of the BCA-St. Paul Building was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. This report is the result of that information.

The Bureau of Criminal Apprehension (BCA) St. Paul is one large building consisting of 235,414 interior square feet. It was built in 2003 and never commissioned. The building contains a large amount of lab space and therefore contains a large number of exhaust fans. There are three floors as well as a penthouse. Floor layouts follow at the end of this report.

### *General HVAC Overview*

The building has a total of 2 chillers, 4 boilers, 7 AHUs, 120 exhaust fans, and 263 VAV boxes. Two of the boilers are used to produce hot water. There are two different hot water loops. One of the hot water loops supplies hot water directly from the boiler to the VAV reheats. The other loop passes hot water from the boiler through two heat exchangers which transfers energy from the boiler water to a glycol hot water system for the heat coils within the AHUs. The other two boilers produce steam for humidification. Six of the AHUs contain humidifier coils in them.

Due to the large amount of air exhausted out of the building, 6 of the AHUs utilize heat reclaim. Each of these AHUs contains an exhaust fan which draws air through a heat reclaim water system. This system is used for both the heating and cooling seasons. This helps reduce the amount of energy used to condition the large amount of OA. The heat reclaim system primarily captures exhaust air energy from the third floor.

There is also a small parking garage attached to the building which is about 600 ft<sup>2</sup>. The only equipment which serves this space is two exhaust fans.

### *Controls and Trending*

The building is controlled by the State Capitol Complex Honeywell EBI automation system. It is operated by the Plant Management Division (PMD) of the Department of Administration. PMD controls the building automation system. The system is fully capable of trending. PMD will set up all trending required for the project based on the direction of the provider. The data will be exported in a standard format such as CSV. A total of 24,000 points can be trended on the automation system. The automation system also serves all the buildings on the St. Paul Capitol complex. There would be 2,000 to 4,000 available points to trend at each building.

### *Lighting*

Most of the interior lighting consists of T8 28 watt lights. These lights are mainly controlled by switches. There are very few occupancy sensors or timers controlling interior lights. A lighting study was completed on the facility in Fall 2009 and will be used as the basis for any lighting recommendations.

### *Access Requirements and Space Conditions*

In order to gain access to the building providers would have to go through a background check and be accompanied by an escort at all times while on site. Visits would have to be scheduled in advance. Many of the lab spaces do not allow a high setback to be initiated due to content and experiments running 24/7.

### *Documentation*

The building was only built seven years ago. Prints and plans are readily available. Balance reports for all the VAVs and control sequences for the mechanical equipment are available.

### *EUI B3 Benchmark Overview*

The actual energy user index (EUI) is currently at 182.2 kBtu/ft<sup>2</sup>. The building benchmark in B3 is 239.2 kBtu/ft<sup>2</sup>. This benchmark was determined by assuming the building is approximately 50% laboratory space, 48% office space, and 2% parking garage.

### *Utility Meters*

There are 2 gas meters, (1interruptible and 1firm); 1 electrical meter and #2 fuel oil for use when natural gas is curtailed.

This screening report is based on the PBEEP Guidelines. It is based on one site visit, review of the facility documentation, building automation system, a limited inspection of the facility and interviews with the staff. The purpose of the screening report is to evaluate the potential of the facility for the implementation of cost-effective energy efficiency savings through recommissioning. To the best of our knowledge the information here is accurate. It provides a high level view of many, but by no means all, of the important parameters of the mechanical equipment in the facility. Because it is the result of a limited audit survey of the facility, it may not be completely accurate.

BCA-St. Paul			State ID# G0231026362																																		
Area (sq.ft)	235,414	Year Built	2003	Occupancy (hrs/yr)	2600																																
HVAC Equipment																																					
- 7 AHUs																																					
<table><tr><th>Name</th><th>Type</th><th>Size</th><th>Notes</th></tr><tr><td>AHU-1</td><td>VAV</td><td>49,000 CFM 75 HP SF, Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-2</td><td>VAV</td><td>49,000 CFM 75 HP SF Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-3</td><td>VAV</td><td>49,000 CFM 75 HP SF Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-4</td><td>VAV</td><td>49,000 CFM 75 HP SF Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-5</td><td>VAV</td><td>49,000 CFM 75 HP SF Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-6</td><td>VAV</td><td>49,000 CFM 75 HP SF Two 20 HP RF</td><td>All fans controlled by VFDs</td></tr><tr><td>AHU-7</td><td>Constant Volume</td><td>8,000 CFM 7.5 HP SF</td><td>Serves the boiler room</td></tr></table>						Name	Type	Size	Notes	AHU-1	VAV	49,000 CFM 75 HP SF, Two 20 HP RF	All fans controlled by VFDs	AHU-2	VAV	49,000 CFM 75 HP SF Two 20 HP RF	All fans controlled by VFDs	AHU-3	VAV	49,000 CFM 75 HP SF Two 20 HP RF	All fans controlled by VFDs	AHU-4	VAV	49,000 CFM 75 HP SF Two 20 HP RF	All fans controlled by VFDs	AHU-5	VAV	49,000 CFM 75 HP SF Two 20 HP RF	All fans controlled by VFDs	AHU-6	VAV	49,000 CFM 75 HP SF Two 20 HP RF	All fans controlled by VFDs	AHU-7	Constant Volume	8,000 CFM 7.5 HP SF	Serves the boiler room
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AHU-7	Constant Volume	8,000 CFM 7.5 HP SF	Serves the boiler room																																		
- 259 VAV boxes with reheat coil and 4 without reheats: CFMs ranging from 180 to 4000 CFM																																					
- 114 Exhaust VAV boxes: 200 to 1700 CFM																																					

- **6 Exhaust Fans with heat reclaim heat coils**

Name	Type	Size	Notes
EF-1	VFD	18,300 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr
EF-2	VFD	19,290 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr
EF-3	VFD	10,210 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr
EF-4	VFD	18,610 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr
EF-5	VFD	22,900 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr
EF-6	VFD	20,955 CFM 25 HP Motor	Reclaim coil rating of 969.5 kBtu/hr

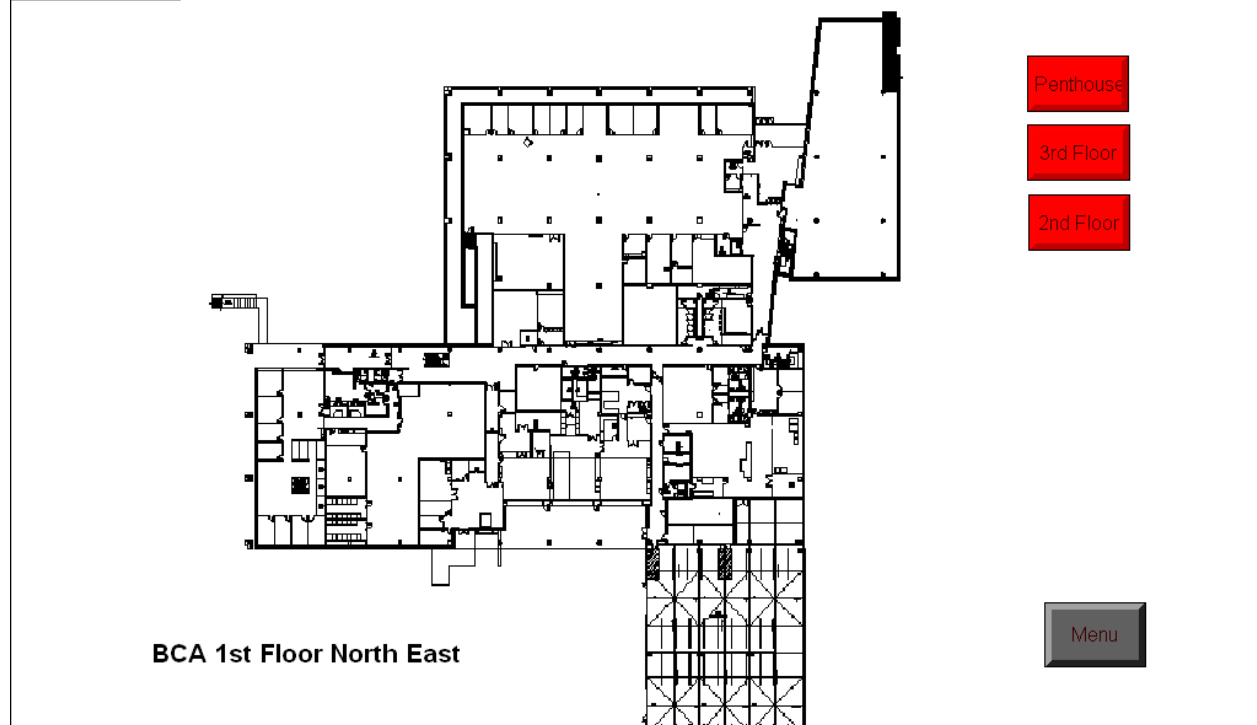
- **4 Heat Recovery Pumps:** for the heat recovery coils rated at 7.5 HP, constant volume
- **2 Chillers:** 700 ton rating each
  - o **3 primary CHWP:** 20 HP each, constant volume
  - o **2 Secondary CHWP:** 40 HP each with VFD
  - o **3 Condenser Water Pumps:** 50 HP each, constant volume
- **2 Cooling Towers:** rated at 2,100 gpm each
- **2 Boilers:** output rating on 10,043 kBtu/hr each, used for hot water
  - o **3 Primary HWP:** 15 HP each, Constant Speed
  - o **2 Secondary HWP:** 30 HP each with VFD for VAV reheats
  - o **3 Secondary HWP:** 15 HP each, constant speed for HX to transfer energy to glycol system for heating coils in AHUs
  - o **3 Glycol HWP:** 10 HP each with VFD, for AHUs HW Coils
- **2 HX:** rated at 200 and 1,456 gpm for glycol system
- **2 Boilers:** output rating of 4,184 kBtu/hr each, used for steam humidification
- **16 EFs:** EF-7 is rated at 35,000 CFM and 10 HP,  
EF-13 and EF-14 are rated at 21,000 CFM and 10 HP  
EF-8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 27, 28 are rated between 300 and 6,200 CFM
- **6 SF:** rated between 6,200 CFM and 8,670 CFM for generator and chiller rooms
- **2 CRAC Units:** rated at 10,000 CFM and 10 HP constant volume
- **4 CUHs:** rated at 52.1 kBtu/hr
- **13 UHs:** rated at 53.4 kBtu/hr
- **10 FCUs:** ratings between 1,200 and 3,000 CF

# Points on BAS for BCA

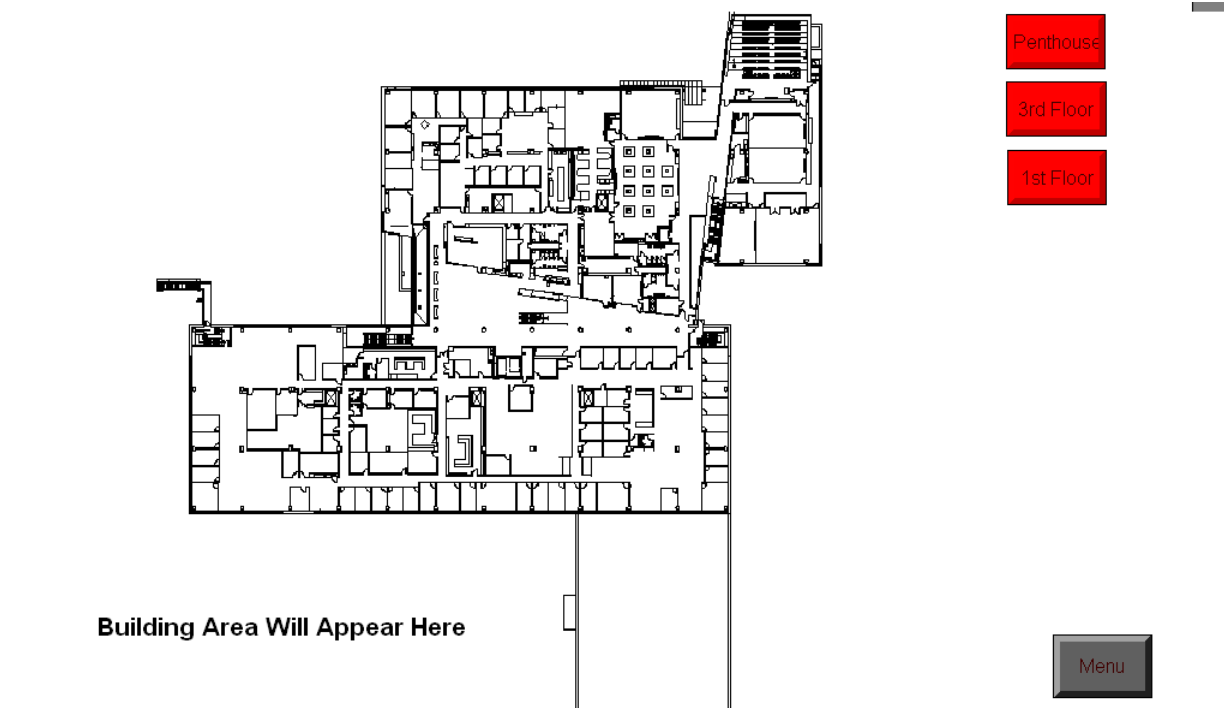
Name	Points
AHU-1 AHU-2 AHU-3 AHU-4 AHU-5 AHU-6	OA damper, OA CFM, OA enthalpy, Filter differential pressure, MAT, Heat reclaim DAT, Heat reclaim valve %, Heat reclaim water supply temperature, Heat reclaim water return temperature, Heat valve %, Cool valve %, Humidifier valve %, SA CFM, VFD speed, VFD status, VFD bypass status, System command, SF alarm, DA humidity, DAT, 1 <sup>st</sup> floor discharge static pressure, 2 <sup>nd</sup> floor discharge static pressure, 3 <sup>rd</sup> floor discharge static pressure, Return dampers from 3 <sup>rd</sup> floor, Return air CFM from 3 <sup>rd</sup> floor, Return dampers from penthouse, Return air CFM from penthouse, RA humidity, RAT, RA enthalpy, Total return CFM, RF VFD speed, RF VFD status, RF bypass status, RF alarm, EA damper %, RA damper %
AHU-7	OA damper, Return damper, Boiler room relief, Heat valve %, Fan alarm, Fan command, DAT, DAT setpoint, Space temperature, Hi space temperature setpoint, Low space temperature setpoint, Static pressure, Static pressure setpoint
Heat Reclaim System	Heat reclaim pump status, Heat reclaim heat enable setpoint, Heat reclaim cool enable setpoint
EF 1-6 (heat reclaim)	Temperature before reclaim coil, Temperature after reclaim coil, Duct static, Duct static setpoint, VFD speed, VFD status, Bypass status, EF failure, EF command, Exhaust CFM
VAV	CFM setpoint, CFM, Damper position, Reheat valve, Room cooling setpoint, Room temperature, Room heating setpoint
Chiller	OAT, OA humidity, Chiller OAT system enable, Chiller 1 status, Chiller 2 status, Primary CHWST, Primary CHWRT, Secondary CHWP command, Secondary CHWP status, CHWP speed, CHWST, CHRT, Flow, CHWDP, CDWRT, CDWST
Hot Water System	OAT, OA humidity, Boiler 1 status, Boiler 2 status, Primary HWST, Primary HWRT, Primary HWP, Secondary HWP command, Secondary HWP status, HWST, HWRT, HWDP setpoint, HWDP, Flow setpoint, Flow
Steam System	OAT, OA humidity, Boiler status, Steam metered flow
Glycol Hot Water System	1/3 HX valve, 2/3 HX valve, Glycol HWP command, Glycol HWP status, Glycol HWP speed, Glycol HWST setpoint, Glycol HWST, Glycol HWRT, Glycol HWDP setpoint, Glycol HWDP
EF	CFM setpoint, CFM
Generator Room Ventilation	Room static setpoint, Room temperature setpoint, Room heating setpoint, Generator room control output, SF start temperature setpoint, SF stop deadband setpoint
FCU	Space temp, Actual space temp setpoint, Heating occ setpoint, Heat valve
CUH and UHs	Space temp, Space temp setpoint, Heat valve
FTR	Radiation valve %, Space temp
Additional Comments	
<ul style="list-style-type: none"> <li>Building was built in 2003 and not known to be commissioned</li> </ul>	

## Floor Maps

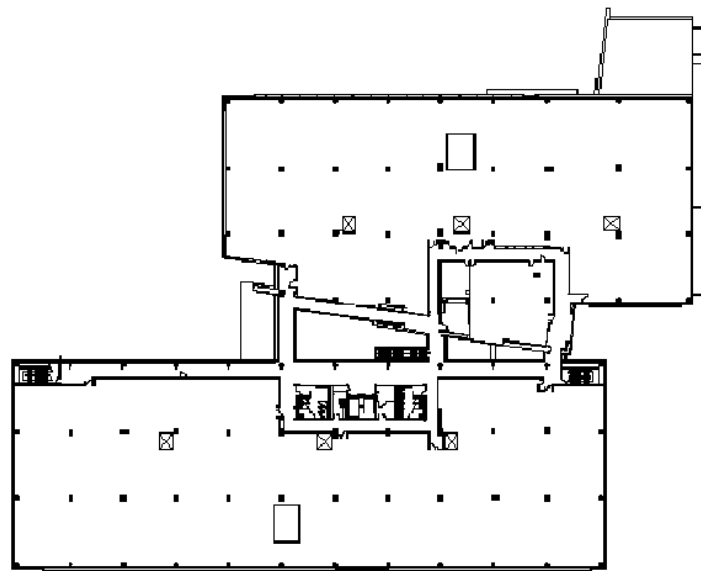
### 1st Floor



### 2<sup>nd</sup> Floor



### 3<sup>rd</sup> Floor



- Penthouse
- 2nd Floor
- 1st Floor

BCA 3rd Floor North East

<b>PBEEP Abbreviation Descriptions</b>			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

<b>Conversions:</b>
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1 kWh = 3.412 kBtu
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1 Therm = 100 kBtu
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1 kBtu/hr = 1 MBH
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